

REMARKS

Status of the Claims

No claims are amended with this paper. Therefore, claims 1-16 are currently pending in the application.

The Invention

Previously-known flame retardant resins may suffer from problems such as corrosion of molding machines due to the flame retarder component, bleed-out of the flame retarder, and mold deposits. The present invention provides flame retardant resin compositions having excellent flame retardancy, mechanical properties, and heat resistance.

The presently-claimed invention is directed to flame retardant resin compositions comprising a thermoplastic polyamide resin, a phosphazene compound, and a phosphazene compatibility enhancing resin or anti-bleed-out resin consisting essentially of a polyphenylene ether-based resin, or a mixture of a polyphenylene ether-based resin and a polystyrene based resin.

While fire-retardant polyamide resins containing a phosphazene compound have been described previously, as described above and in the subject specification, polyamide resin can suffer "bleed-out" of a phosphazene flame retardant due to poor compatibility of the phosphazene additive with the polyamide. It has been discovered by the present inventors that the addition of certain amounts of a polyphenylene ether-based resin (PPE) or polystyrene ether-based resin (PS) (or a mixture of PPE and PS) to the polyamide resin can improve the compatibility of the polyamide resin component and the phosphazene component, thereby reducing or prevent the bleed-out of the flame retarder in the polyamide resin composition and the attendant problems such as corrosion of molding machines, bleed-out of the flame retarder, and mold deposits. The compositions of the invention therefore represent an improvement over the prior art compositions.

Thus, in one aspect (as claimed in claim 1), the present invention provides a flame retardant resin composition comprising

100 parts by weight of a thermoplastic polyamide resin (A),

1 to 100 parts by weight of a phosphazene compound (C), and

a phosphazene compatibility enhancing resin (B), consisting essentially of a polyphenylene ether-based resin, or a mixture of a polyphenylene ether-based resin and a polystyrene based resin being present in an amount of 10 to 500% by weight based on the weight of said phosphazene compound (C).

The Office Action

Applicants appreciate the Examiner's thorough review of the application. Applicants request reconsideration of the application in view of the comments which follow.

Claims Rejections – 35 U.S.C. §103(a)

Claims 1-15 stand rejected under 35 U.S.C. §103(a) as unpatentable over Nakacho *et al.*, EP 0945478 ("Nakacho") in view of Ida et al. (US 6,337,031) or An et al. (US 5,028,347). This rejection is traversed.

The Examiner has cited Nakacho as disclosing resin compositions that may comprise a flame retardant, a thermoplastic resin, and a modified polyphenylene ether (with or without a polystyrene resin). The Examiner further states that

[t]he employment of a polyamide, modified polyphenylene ether, styrene resin and modified styrene resins in combination is shown at page 10 paragraphs [0075] and [0076] . . . At page 4, the reference teaches the compositional limitations to comprise (a) 100 parts by wt of resin, (b) 0.1 to 100 parts by wt of a flame retardant, and (c) 0.1 to 50 parts by wt of organic phosphorus compound.

Office Action at pages 2-3.

The Examiner further states that “the compositional limitations at paragraph [0082] for the flame retardant embraces that of the instant claims.” Office Action at page 5. These statements are traversed.

As the reference is understood, Nakacho discloses flame retardants and flame retardant resins comprising a thermoplastic resin and a crosslinked phenoxyphosphazene compound. The phenoxyphosphazene compound can be selected from a group of cyclic phosphazenes or straight-chain phosphazenes. A lengthy list of possible thermoplastic resins is recited by Nakacho at page 10, paragraphs 75-77, with paragraph 76 having a list of thermoplastic resins: “polyester, ABS resin, polycarbonate, modified polyphenylene ether, polyamide, etc. are preferably used.” (emphasis added). This cannot be seen as a specific teaching of the claimed compositions; at most, Nakacho discloses that polyamide can be used as a resin in combination with many other resins; however, there is no teaching or suggestion of the presently-claimed combinations of polyamide resin, anti-bleedout resin or phosphazene compatibility enhancing resin, and flame retardant.

Although Nakacho mentions polyamide as one resin, Applicants note that compositions including polyamide resins are not exemplified through working examples in the Nakacho reference. Despite the Examiner’s assertion quoted above, the composition generally described at paragraph 82 of Nakacho, while it generally describes amounts of flame retardants that may be present, does not teach or suggest the *specific combinations* of materials required by the pending claims, nor are the claimed *amounts* of resins disclosed in Nakacho.

Applicants respectfully submit that Nakacho provides no teaching or suggestion of a composition according to the presently-pending claims. In particular, Nakacho does not teach or suggest a flame-retardant resin having a thermoplastic polyamide resin, a phosphazene compound and a phosphazene compatibility enhancing resin (or anti-bleed-out resin) consisting essentially of a polyphenylene ether (PPE)-based resin, or a mixture of PPE resin and a polystyrene (PS)- based resin in the amounts required by the pending claims. While the Nakacho reference mentions in passing that combinations of thermoplastic resin can be used, and

despite the Examiner's assertion quoted above, the composition generally described at paragraph 82 of Nakacho, while it generally describes amounts of flame retardants that may be present, does not teach or suggest the *specific combinations* of materials required by the pending claims, nor are the claimed *amounts* of resins disclosed in Nakacho.

In support of the rejection, the Examiner points to the Nakacho reference as teaching the "[c]ompositional limitations to comprise (a) 100 parts by wt of resin, (b) 0.1 to 100 parts by wt of a flame retardant, and (c) 0.1 to 50 parts by wt of organic phosphorus compound." Applicants respectfully submit that this portion of the Nakacho reference does not teach or suggest all elements of the claimed invention.

Paragraph 26 of Nakacho (at page 4, lines 6-13) describes certain resin compositions denominated (a), (b), (c), and (d), each including a thermoplastic or thermosetting resin (100 parts by weight) and "flame retardant A" (0.1 to 100 parts by weight for resins (a), (b), and (d); 0.1 to 50 parts by weight for resin (c)). "Flame retardant A" of Nakacho is described at paragraph 24 of Nakacho (page 3, lines 53-54) as "a flame retardant comprising said crosslinked phenoxyphosphazene compound." Composition (c), which the Examiner appears to be citing above, additionally includes "0.1 to 50 parts by weight of an organic phosphorus compound free of halogen." Nakacho further teaches (e.g., at page 2, lines 29-33) that organic phosphorus compounds are useful as flame retardants.

Thus, the resins described at paragraph 26 of Nakacho include a thermoplastic or thermosetting resin and a phenoxyphosphazene flame retardant, optionally further including materials such as inorganic fillers or additional flame retardants. None of these compositions, including composition (c) of Nakacho, includes a phosphazene compatibility enhancing resin (or anti-bleed-out resin) consisting essentially of a polyphenylene ether (PPE)-based resin, or a mixture of PPE resin and a polystyrene (PS)-based resin, in the amounts required by the pending claims.

The Nakacho reference contains no teaching or suggestion of a composition including a phosphazene compatibility enhancing resin (or anti-bleed-out resin) consisting essentially of a

PPE-based resin, or a mixture of a PPE-based resin and a PS-based resin, in specific amounts, as required by the pending claims. Accordingly, Applicants contend that the Nakacho reference cannot and does not render the claimed invention obvious.

As discussed above, the Nakacho reference does not provide any teaching or suggestion that polyamide resins can suffer from poor compatibility with phosphazene flame retardants. It is also clear that the Nakacho reference also does not teach or suggest a solution to the issue of poor compatibility, such as the presently-claimed use of a phosphazene compatibility enhancing resin or anti-bleed-out resin in *specified amounts* relative to the amount of the phosphazene compound. Thus, the Nakacho reference cannot and does not provide any motivation to the skilled artisan to select the presently-claimed elements, in the claimed amounts. The Nakacho reference does not render obvious the claimed invention.

Neither Ida nor An, whether taken singly or in combination, can overcome the deficiencies of Nakacho.

The Examiner has cited the Ida reference as disclosing a flame-retardant resin magnet material comprising a magnetic powder based on ferrite. The Examiner further states that it would have been obvious to add the magnetic powder of Ida to the composition of Nakacho with the expectation of obtaining a molded article such as a magnet, having flame retardancy as well as magnetism. Applicants disagree with this contention as applied to the present claims.

While the Ida reference discloses magnetic flame-retardant materials obtained by adding an alnico or ferrite-based magnetic powder to a flame-retardant resin comprising aluminum hydroxide, antimony trioxide, and polyamide, the Ida reference contains no teaching or suggestion of the use of phosphazene compounds as flame retardants, and, *a fortiori*, does not contain any teaching of the addition of a phosphazene compatibility enhancing resin (or anti-bleed-out resin) to a fire retardant polyamide composition. Indeed, the Ida reference actually states that "it is completely unclear whether polyamide resins can be used as base resins, not to mention the fact that no information is yet available concerning the mixing ratios of various flame retardants in cases in which such polyamide resins are used as base resins," see, e.g., Ida at

Column 2, lines 36-41. The flame retardants disclosed in the Ida reference for use with polyamides do not include phosphazenes.

Therefore, no combination of Nakacho and Ida teach or suggest the subject matter of any of the pending claims. There is simply no teaching in the Ida reference that (alone or in combination with the other cited references) would lead one of skill in the art to arrive at the claimed invention. Indeed, the Ida reference suggests, as described above, that the use of polyamide resins with flame retardants is “unclear”; Ida does not teach or suggest the use of phosphazenes, nor the need for compositions containing phosphazene compatibility enhancing resins.

The Examiner has cited An as disclosing a flame-retardant magnetic composite resin composition that may comprise a magnetic powder. The Examiner avers that it would have been obvious to add An’s magnetic powder to the composition of Nakacho with the expectation of obtaining a molded article such as a magnet, having flame retardancy as well as magnetism. Applicants respectfully disagree.

As discussed *supra*, Nakacho contains no teaching or suggestion of a composition including a phosphazene compatibility enhancing resin (or anti-bleed-out resin) consisting essentially of a PPE-based resin, or a mixture of a PPE-based resin and a PS-based resin, in specific amounts, as required by the pending claims.

The An reference discloses magnetic flame-retardant resin compositions comprising a polyamide resin, a phenol derivative, a thiophosphate compound, a copper compound, a flame-retardant agent, a flame-retardant synergist, and a magnetic powder which is treated with a surface-modifying agent. However, the An reference does not teach or suggest the use of phosphazene compounds as fire retardants, and does not contain any teaching of a composition including a phosphazene compatibility enhancing resin (or anti-bleed-out resin), in the claimed amounts, to a flame retardant polyamide composition.

Therefore, no combination of Nakacho and An can teach or suggest the subject matter of any of the pending claims. There is simply no teaching in the An reference that (alone or in combination with the other cited references) would lead one of skill in the art to arrive at the claimed invention.

The Examiner also states (presumably with reference to pending claim 15) that the teachings of An “would suggest [to] one of ordinary skill in the art to surface treat glass fibers in the flame retardant composition of Nakacho in order to improve dispersability and thereby enhance mechanical strength and flowability.” Applicants respectfully disagree.

First, as described above, the teachings of the Nakacho and An references, whether taken alone or in combination, do not teach or suggest any of the resin compositions of the invention as claimed. Thus, all the pending claims, including claim 15, are patentable over these references, alone or in combination.

Second, Applicants respectfully submit the teachings of An cannot be applied to the composition of claim 15, in which a glass fiber (as an inorganic filler) is surface-treated with a silane-based coupling agent. An teaches surface modification of magnetic particles, but An does not teach or suggest incorporation of *glass fibers* into resin compositions. As described in the present specification, e.g., at page 11, lines 19-21, glass fibers can be surface-treated with a silane-based coupling agent “in order to enhance adhesion to the polyamide resin.” An cannot and does not teach or suggest incorporation in the resin of a surface-modified glass fiber such as glass fibers treated with silane-based coupling agents (e.g., as required by pending claim 15).

Nakacho also does not disclose a surface-treated glass fiber with a silane-based coupling agent. Thus, no combination of Nakacho and An teaches or suggests the composition of claim 15.

Applicants respectfully contend that the Examiner has not made out a *prima facie* case of obviousness of the claimed invention. As provided in the MPEP, “the fact that a claimed species or subgenus is encompassed by a prior art genus is not sufficient by itself to establish a *prima*

facie case of obviousness.” MPEP 2144.08(II) , citing In re Baird, 16 F.3d 380, 383 (Fed. Cir. 1994). In the instant case, neither Nakacho, nor any of the prior art references, whether taken alone or in combination, provide a teaching or suggestion of the specific compositions of the pending claims.

Reconsideration and withdrawal of these rejections is proper and the same is requested.

Claim 16 is rejected under 35 U.S.C. §103(a) as being unpatentable over Nakacho (EP 0945478) in view of Ida (US 6,337,031) or An (US 5,028,347), and further in view of White (US 4,806,602). This rejection is traversed.

White does not overcome the deficiencies of Nakacho in view of Ida and/or An discussed *supra*. As described above, none of Nakacho, An, or Ida, alone or in combination, contain any teaching or suggestion of the addition of a phosphazene compatibility enhancing resin (or anti-bleed-out resin) consisting essentially of a PPE-based resin, or a mixture of a PPE-based resin and a PS-based resin, in specific amounts to a polyamide resin, as required by the pending claims.

The Examiner states that White describes anhydride capping of polyphenylene ether with carboxylic acid. The Examiner then states that it would have been obvious in view of the teachings of White to modify the polyphenylene ether resin used in the flame retardant composition of Nakacho since such a modified resin would be, according to the Examiner, less susceptible to oxidative degradation. Applicants respectfully disagree.

The White reference discloses a method to cap a polyphenylene ether; however, there is no description or suggestion of its use in flame retardant resin compositions. There is no teaching or suggestion in White of a fire retardant resin comprising polyamide resin, a phosphazene compound and a phosphazene-compatibility enhancing resin in the amounts required by pending claim 16. There is clearly no teaching or suggestion in White that such a resin could be modified as suggested by the Examiner to achieve the allegedly superior results. One of the ordinary skill in the art would not be motivated to combine Nakacho, Ida and An with

White in the manner proposed by the Examiner. The Examiner's assertion that this combination would have been obvious appears to be impermissible hind-sight, using the present specification as a blueprint to reconstruct the claimed invention from the isolated teachings of the prior art. This is improper. See, e.g., *Grain Processing Corp. v. American Maize-Prods. Co.*, 840 F.2d 902, 907, 5 USPQ2d 1788, 1792 (Fed. Cir. 1988).

Applicants respectfully contend that the Examiner has not made out a *prima facie* case of obviousness of the claimed invention. None of the prior art references, whether taken alone or in combination, provide a teaching or suggestion of the specific compositions of the pending claims. Reconsideration and withdrawal of the rejections is proper and the same is requested.

Unexpected Results

Moreover, even if the Examiner has established a *prima facie* case of obviousness (which Applicants dispute), the claimed invention nevertheless patentably distinguishes the cited references. As described in above and in the subject specification, the claimed compositions provided unexpectedly superior properties compared to previously known compositions. As described in the instant specification and discussed herein, the present compositions are unexpectedly resistant to "bleed-out" of the flame retardant compound and the attendant problems.

First, the present specification provides examples of compositions according to the claimed invention (with an anti-bleed-out resin or phosphazene compatibility enhancing resin) and also compositions without an anti-bleed-out resin or phosphazene compatibility enhancing resin. As shown in Examples 1-8, in every composition including an anti-bleed-out or phosphazene compatibility enhancing resin according to the invention, the bleed-out of the phosphazene compound was low (i.e., was rated "Good" in Table 1). In contrast, as shown in Comparative Examples 1-6, in compositions lacking an anti-bleed-out resin or phosphazene compatibility enhancing resin according to the invention, the bleed-out of phosphazene

compound was rated "Poor" (the only exception being Comparative Example 1, in which there was no phosphazene flame retardant in the composition). These results clearly demonstrate the advantages of the claimed invention.

Second, the attached Declaration of Mr. Suzuki (one of the inventors of the claimed subject matter) describes several experiments performed to compare the properties of several compositions, including compositions of the present invention. As described in more detail in the Declaration, compositions of polyamide resin, phosphazene compound, and glass fiber, with or without the addition of an anti-bleed-out or phosphazene compatibility enhancing resin (in this case, polyphenylene ether-based resin (PPE)) were mixed and the resulting compositions were extracted with acetone (to measure bleed-out of the phosphazene compound). As described in the Declaration, the composition which included 20 parts of PPE had much less bleed-out of the phosphazene flame retardant (0.004%) compared to the composition lacking an anti-bleed-out resin (0.05% bleed-out). Moreover, inspection of the test articles showed that the surface of the article made from the composition including an anti-bleed-out resin was glossy and not sticky. In contrast, inspection of the test article lacking an anti-bleed-out phosphazene compatibility enhancing additive showed that the surface of the article was cloudy or dull, and felt sticky to the touch.

The results discussed above demonstrate that compositions including an anti-bleed-out resin or phosphazene compatibility enhancing resin according to the invention have unexpectedly superior properties when compared to compositions lacking an anti-bleed-out resin. As discussed above, none of the cited references (alone or in combination) teaches or suggests that polyamide resins can suffer from poor compatibility with phosphazene flame retardants. The reference also do not teach or suggest a solution to the issue of poor compatibility, such as the presently-claimed use of a phosphazene compatibility enhancing resin or anti-bleed-out resin in *specified amounts* relative to the amount of the phosphazene compound. Thus, the cited references cannot and do not provide any motivation to the skilled artisan to select the presently-claimed elements, in the claimed amounts.

Thus, Applicants contend that the claimed compositions, including the specified amount of anti-bleed-out resin, patentably distinguish over the teachings of the cited references.

Reconsideration and withdrawal of the rejection is proper and the same is requested.

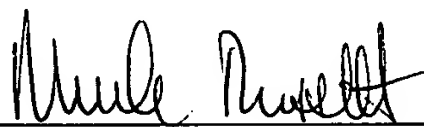
Conclusion

For at least the above reasons, Applicants request reconsideration of the application and an early indication of allowability.

The undersigned requests any extensions of time necessary for response. Although it is not believed that any additional fees are needed to consider this submission, the Director is hereby authorized to charge our Deposit Account No. 04-1105, under Docket No. 55968 (71360), Customer No. 21874 should any fee be deemed necessary. If the Examiner considers that obstacles to allowance still exist, the undersigned invites a telephone call at the number indicated below.

Respectfully submitted,

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